

Claims:

1. A system for simulating the metabolic consumption of oxygen contained in a breathable gas, comprising:

a variable volume chamber that cyclically increases in volume to receive said breathable gas and then cyclically decreases in volume to expel an exhaust gas;

a source of hydrogen gas coupled to said chamber;

a source of carbon dioxide gas coupled to said chamber;

means for introducing said hydrogen gas and said carbon dioxide gas into said chamber to mix with said breathable gas thereby forming said exhaust gas, wherein said exhaust gas includes hydrogen and oxygen, wherein said hydrogen gas is introduced in an amount sufficient to react with an amount of said oxygen in said exhaust gas equivalent to that used by a human during a selected level of activity, and wherein said carbon dioxide gas is introduced in an amount equivalent to that provided by a metabolic respiratory quotient associated with said level of activity; and

a catalyst coupled to said chamber for receiving said exhaust gas, said catalyst causing a reaction between said hydrogen and said oxygen in said exhaust gas wherein simulated human exhalation is generated.

1 2. A system as in claim 1 wherein said source of said
2 hydrogen gas and said source of said carbon dioxide gas
3 comprise a single source of a mixture of said hydrogen gas
4 and said carbon dioxide gas.

1 3. A system as in claim 1 wherein a volume percentage of
2 said hydrogen gas in said exhaust gas comprises less than
3 approximately one percent.

1 4. A system as in claim 1 wherein said catalyst is a
2 precious metal.

1 5. A system as in claim 4 wherein said precious metal is
2 selected from the group consisting of palladium and platinum.

1 6. A system for simulating the metabolic consumption of
2 oxygen contained in a breathable gas supplied by a breathing
3 apparatus, said system comprising:

4 a variable volume chamber that is operated cyclically
5 wherein said chamber is operating in one of a vacuum mode to
6 increase volume of said chamber and a pump mode to decrease
7 volume of said chamber;

8 valve means coupled between said breathing apparatus
9 and said chamber for defining a first flow path therethrough
10 during said vacuum mode, said first flow path allowing said
11 breathable gas to be drawn into said chamber;

12 a source of hydrogen gas coupled to said chamber;

13 a source of carbon dioxide gas coupled to said chamber;

14 means for introducing said hydrogen gas and said carbon
15 dioxide gas into said chamber to mix with said breathable gas
16 during said vacuum mode to form an exhaust gas, wherein said
17 exhaust gas includes hydrogen and oxygen, wherein said
18 hydrogen gas is introduced in an amount sufficient to react
19 with an amount of said oxygen in said exhaust gas equivalent
20 to that used by a human during a selected level of activity,
21 and wherein said carbon dioxide gas is introduced in an
22 amount equivalent to that provided by a metabolic respiratory
23 quotient associated with said level of activity;

24 said valve means defining a second flow path

25 therethrough during said pump mode, said second flow path
26 allowing said exhaust gas to be expelled from said chamber;
27 and

28 a catalyst coupled to said valve means for receiving
29 said exhaust gas during said pump mode, said catalyst causing
30 a reaction between said hydrogen and said oxygen in said
31 exhaust gas wherein simulated human exhalation is generated.

1 7. A system as in claim 6 wherein said breathing apparatus
2 is a closed circuit breathing apparatus, said valve means
3 coupling said catalyst to said breathing apparatus, wherein
4 said second flow path directs said simulated human exhalation
5 to said breathing apparatus during said pump mode.

1 8. A system as in claim 6 wherein said variable volume
2 chamber comprises a piston/cylinder assembly, and wherein
3 said pump mode occurs during a power stroke of said
4 piston/cylinder assembly and said vacuum mode occurs during a
5 return-to-battery stroke of said piston/cylinder assembly.

1 9. A system as in claim 6 wherein said source of said
2 hydrogen gas and said source of said carbon dioxide gas
3 comprise a single source of a mixture of said hydrogen gas
4 and said carbon dioxide gas.

1 10. A system as in claim 6 wherein a volume percentage of
2 said hydrogen gas in said exhaust gas comprises less than
3 approximately one percent.

1 11. A system as in claim 6 wherein said catalyst is a
2 precious metal.

1 12. A system as in claim 11 wherein said precious metal is
2 selected from the group consisting of palladium and platinum.

1 13. A method of simulating the metabolic consumption of
2 oxygen contained in a breathable gas supplied by a breathing
3 apparatus, said method comprising the steps of:

4 providing a variable volume chamber capable of cyclic
5 operation in one of a vacuum mode to increase volume of said
6 chamber and a pump mode to decrease volume of said chamber;

7 directing said breathable gas into said chamber during
8 said vacuum mode;

9 introducing hydrogen gas and carbon dioxide gas into
10 said chamber to mix with said breathable gas during said
11 vacuum mode to form an exhaust gas, wherein said exhaust gas
12 includes hydrogen and oxygen, wherein said hydrogen gas is
13 introduced in an amount sufficient to react with an amount of
14 said oxygen in said exhaust gas equivalent to that used by a
15 human during a selected level of activity, and wherein said
16 carbon dioxide gas is introduced in an amount equivalent to
17 that provided by a metabolic respiratory quotient associated
18 with said level of activity;

19 providing a catalyst capable of causing a reaction
20 between said hydrogen and said oxygen in said exhaust gas;
21 and

22 directing said exhaust gas from said chamber to said
23 catalyst during said pump mode wherein simulated human
24 exhalation is generated.

1 14. A method according to claim 13 wherein said breathing
2 apparatus is a closed circuit breathing apparatus, said
3 method further comprising the step of directing said
4 simulated human exhalation to said breathing apparatus during
5 said pump mode.

1 15. A method according to claim 13 wherein said step of
2 introducing comprises the step of separately introducing said
3 hydrogen gas and said carbon dioxide gas into said chamber.

1 16. A method according to claim 13 further comprising the
2 step of mixing said hydrogen gas with said carbon dioxide gas
3 prior to said step of introducing.

1 17. A method according to claim 13 wherein said step of
2 introducing includes the step of maintaining a volume
3 percentage of said hydrogen gas in said exhaust gas that is
4 less than approximately one percent.

1 18. A method according to claim 13 wherein said reaction
2 produces heat and water vapor.